Mandatory Reporting of GHGs for the Power/Utilities Sector DRAFT REGULATORY CONCEPTS

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Note to Reviewers

Staff assumes that a high level of accuracy is appropriate for mandatory reporting; thus, for complex fuels, some optional methodologies my include heat content and/or carbon content measurements.

1. Who Will Report

Power Generating Facilities ≥ 1 MW

Reporting will be required of the party with operational/management control (not equity share) corresponding to responsibility to implement health, environmental, and safety rules for the facility.

For the purposes of this regulation, hydro-electric generation, wind power generation, nuclear power generation, and solar power generation will be considered to have insignificant GHG emission and will not be required to report.

Electric Retail Providers

Co-Generation and Self-Generation facilities ≥ 1 MW will report; however, reporting methodologies and other requirements for these facilities will be discussed in a separate section of the regulation devoted specifically to co-generation and self generation. All co-generation and self-generation units that are part of a refinery, cement plant, or general combustion facility already required to report under a another sector, will report regardless of size. These sectors will also reference back to the section devoted to co-generation.

2. What GHGs Will Be Reported

Six Kyoto Gases: CO_2, N_2O, CH_4, HFCs, PFCs, SF_6

3. What Sources Will Be Reported

A. Generating Facilities Will Report

Annual Reporting By Power Unit

- MW rating and Annual Net MWh of Power Generated
- Annual Fuel consumption
- Average Annual Heat Content
- Average Annual Carbon Content if Measured
- CO_2, N_2O, CH_4 Emissions from Combustion

Process CO_2 from Acid Gas Scrubbers

Fugitive CH_4 from Coal Storage

Fugitive CO_2 from Geothermal

B. Retail Providers Will Report
Facility Emissions Defined in Part A of Section 3 if applicable plus

Fugitive SF6 Emitted within Retail Provider Service Area

Retail Providers are required to compile information on SF6 used in transmission and distribution lines within the service area of the Retail Provider. The reporting of this information is NOT an allocation of responsibility for the emissions in a future trading scheme. It does mean that, in some cases, the Retail Providers will need to contact other agencies who maintain the lines within the service area in order to compile the necessary information. ARB will use the "bottom-up" SF6 information to improve the statewide inventory.

CO2 from mobile sources $\geq$ 25,000 metric tons per year

Power Purchased and Consumed for End-Use in Buildings/Facilities operated by utility (Not consumed in power generation)

Methodologies to characterize power purchases, sales, and utility level emission factors will be addressed in the CPUC/CEC recommendations. The methodologies will include a mechanism to account for line losses. Information to be addressed by CPUC/CEC:

CO2, N2O, CH4, MWh from
Power Purchases
- Known-Specified Facilities
- known retail providers
- known region

Wholesale Sales
- Out-of-state wholesale sales (exports)
- In-state wholesale sales
- Sold to Power Marketers

Emission Factors for Use by Customers for each utility product

4. Default Emission Factors Used in Emissions Calculations
ARB will provide necessary default emission factors such as carbon content and oxidation fractions by fuel type. ARB will update and augment these factors as needed.

5. Consistent Use of Emissions Methodologies
When more than one emissions calculation methodology is allowed for mandatory reporting, the reporting facility will select one method and continue to use the same methodology each year to ensure consistency over time.

6. Combustion Emissions

CO_2, N_2O, and CH_4 emissions from combustion of fossil and non-fossil fuels will be reported by power unit.

A. CO_2 from Natural Gas and Complex Fuels

Natural Gas

All facilities currently reporting to U.S. EPA under 40 CFR Part 75 will report annual CO_2 emissions based on Part 75 data as well as average annual heat content (HHV) based on measured data. Generators using natural gas but not subject U.S. EPA Part 75 will use methods provided in Part B of this section.

Coal, Petroleum Coke, Refinery Gas

These fuels may use either Option 1 or Option 2 methodologies.

Option 1: CO_2 CEMS Method

CO_2 CEMS data under the supervision/oversight of a regulatory agency (federal, state, or local air district) will be used for mandatory reporting.

The method uses CO_2 continuous emissions monitoring systems (CEMS) data to calculate emissions. Emissions are based on CO_2 concentration, stack gas flow rates, and CO_2 mass emissions. Average annual heat content (HHV) will also be reported. Facilities subject to U.S. EPA Part 75 data, will report Part 75 data.

OR

Option 2: Fuel-Based Method

This method is a fuel-based methodology based on (1) weekly measured fuel consumption, (2) weekly measured heat content based (HHV), (3) weekly fuel analysis of carbon content, (4) and default oxidation fraction of 1.0 (per latest IPCC guidance). Facilities will use ASTM International testing standards for heat and carbon analysis. (ARB is considering if more frequent heat and carbon analysis is needed for refinery gas.)

Biomass and Municipal Solid Waste (MSW)

Facilities that combust biomass or MSW will report using the CO_2 CEMS method if the facility already operates CO_2 CEMS under the supervision of a regulatory agency. Generators that combust biomass or MSW but do NOT operate a CO_2 CEMS will use the alternative methodology provided in Part B of this section.

B. CO_2 Combustion Methodologies for Fuels NOT specified in Section 7A

CO_2 emissions from combustion of fossil and non-fossil fuels by power unit will be calculated using either Option 1 (Fuel-Based) or Option 2 (CO_2 CEMS Based) except for the specific fuels and circumstances already identified in Part A.

Option 1: Fuel-Based Method

Fuel Method is based on:

1. Measured consumption of each fossil and non-fossil fuel type combusted in frequencies as follows—
   - For periods that match new shipments/deliveries for middle distillates (diesel, fuel oil, kerosene), fuel oil (residual oil), LPG (ethane, propane, isobutene, n-Butane, unspecified LPG)
   - Daily for natural gas, landfill gas, biogas from waste water treatment, biomass, MSW
2. Heat content measured (HHV using ASTM International testing standards) or provided by fuel supplier for frequencies as follows--
   - With each new shipment/delivery for middle distillates (diesel, fuel oil, kerosene), fuel oil (residual oil), LPG (ethane, propane, isobutene, n-Butane, unspecified LPG)
   - Monthly for natural gas
   - Daily for landfill gas, biogas from wastewater treatment, biomass, MSW
3. Default carbon content factors provided by ARB
4. Default oxidation fractions provided by ARB

$$CO2 = \sum_{P=1}^{n} Fuel_P * HC_P * [CC_{EF} * OF * (3.667)]$$

Where:

CO2 = combustion emissions from specific fuel type, annual metric tons

P = Period/frequency of heat content measurements over the year

$Fuel_P$ = Mass or volume of fuel combusted for the measurement period specified by fuel type in Item #1 above.

HC_P = Heat content measured for the measurement period specified by fuel type in Item #2 above.

CC_{EF} = Default carbon content emission factor

OF = Default oxidation factor for fuel type

3.667 = Molecular weight of CO2 (44) divided by the molecular weight of carbon (12)

OR

Option 2: CO2 CEMS Method

The method uses CO2 CEMS data to calculate emissions. Emissions are based on CO2 concentration, stack gas flow rates, and CO2 mass emissions. Average annual heat content (HHV) will also be reported. CEMS is supervised by a regulatory agency (federal, state, or local air district.

C. Additional Specifications

Carbon Neutral Fuels
CO_2 emissions from biomass, landfill gas, and biogas from waste water treatment will be considered carbon neutral and categorized as such in the database. Information on other fuels shown to be carbon neutral may be submitted to the ARB for consideration and approval at the discretion of the Executive Officer.

Emissions from MSW will be not be considered carbon neutral unless a carbon neutral portion is determined using the method approved under ASTM D6866 and testing frequencies are approved by the Executive Officer (what frequency is reasonable?)

Co-Firing
If a carbon neutral fuel is co-fired with a fossil fuel, emissions from the fossil fuel will be reported separately from the carbon neutral fuel using applicable methodologies provided above. When the CEMS method is used Option 1 or Option 1 methods will be used to calculate the fossil fuel emissions to be subtracted fro the total CO_2 CEMS emission calculations.

Option 1: Fuel-Based

A fuel-based method may be used to calculate fossil fuel emissions to be subtracted from the total CO_2 CEMS emission calculations.

Option 2: ASTM D6866 Methodology

A methodology based on ASTM D6866 done at frequencies approved by the Executive Officer may be used. (What measurement frequency is reasonable?)

If two fossil fuels are co-fired without the benefit of CEMS, then CO_2 emissions will be calculated separately for each fuel type.

D. N20 and CH4 Combustion Methodologies
N_2O and CH_4 will be reported separately using either Option 1 or Option 2 below.
(Note: There will be no need to convert emission calculations into CO_2e because ARB database will automatically calculate the conversions.)

Option 1

Use of N_2O or CH_4 stack testing data and appropriate ASTM methods if under supervision by a regulatory agency (federal, state, or local air district). (What frequency is needed?)

OR

Option 2

Use the fuel-based methodology described under CO2 combustion methods by substituting default emissions factors by fuel type for N20 and for CH4 provided by ARB in place of default carbon content factors.

7. Process Emissions

A. CO2 Acid Gas Scrubbers Methodology

If CO2 CEMS methods is NOT used, then report CO2 emissions from acid gas scrubbers using the following:

Acid Gas Scrubbers Methodology

$$CO2 = S * R * (CO2_{MW} / Sorbent_{MW})$$

Where:
CO2 = CO2 emitted from sorbent, annual metric tons
S = Limestone or other sorbent used, annual metric tons
R = Ratio of moles of CO2 released upon capture of one mole of acid gas
$CO2_{MW}$ = molecular weight of carbon dioxide (44)
$Sorbent_{MW}$ = molecular weight of sorbent (if calcium carbonate, 100)

8. Fugitive Emissions

A. Fugitive SF6 Methodology

Utilities will compile information and calculate SF6 emissions from transmission and distribution line circuit breakers located within the utility's service area using the following method:

Fugitive SF6 Methodology

Mass Balance Methodology used by U.S. EPA SF6 Emission Reduction Partnership for Electric Power Systems.

1. Determine Change in SF6 Inventory
2. Determine Purchases/Acquisitions of SF6
3. Determine Sales/Disbursements of SF6
4. Determine the Net Increase in Total Full Charge/Nameplate Capacity of SF6 of the Equipment
5. Determine Total Annual Emissions (1+2-3-4)

B. Fugitive HFCs from Cooling Units that Support Power Generation

Generating facilities will report fugitive HFCs from cooling units used in support to power generation.

Fugitive HFCs from Cooling Units Methodology

Mass balance methodology. HFCs = A-B+C-D-E Where: HFCs = HFC emissions, annual metric tons A = Quantity HFCs in storage at the beginning of the year B = Quantity HFCs in storage at the end of the year. C = Sum of HFCs acquired during the year either in storage containers or in equipment D = Sum of HFCs sold or disbursed during the year either in storage containers or in equipment. E = Quantity of full charge/nameplate capacity of new equipment minus the total full charge of retiring equipment

C. Fugitive CH4 from Coal Storage

Facilities that combust coal will use the following method to calculate fugitive CH4 from coal storage

Fugitive CH4 Methodology

CH4 = PC * EF * CF_1 / CF_2 Where CH4 = CH4 emissions, annual metric tons PC = Purchased coal, annual ton EF = Default emission factor for CH4 based on coal origin and provided by ARB, scf CH4/ton CF_1 = Conversion factor equals 0.042, lbs CH4/scf CF_2 = Conversion factor equals 2,204.6, lbs/metric ton

D. Fugitive CO2 from Geothermal Power Generation

CO2 emissions from the geothermal resource will be estimated using the following method.

Mass balance approach

Periodic gas chromatograph measurements, calculated vent gas flows and gross power production rates will be used to produce pounds CO2 per gross megawatt hour emission factors for each facility. Applicable ASTM methods will be used. The emission factor will be multiplied by the gross megawatt hours produced during the year to calculate annual emissions. The total emission value includes CO2 emissions resulting from thermal energy field emissions due to venting wells, freeze protection, and pipeline startups, etc. Also included are CO2 emissions from H2S burner equipped plants that incinerate vent gasses containing CH4 emissions that are converted to CO2 in the process. (What frequencies are appropriate?)

9. Mobile Emissions

Retail Providers will report CO_2 emissions from fuel combustion for mobile sources if total mobile emissions are > 25,000 metric tons per year. The emissions calculation will be based on total annual fuel consumption by fuel type and default emissions factors provided by ARB. The emissions by fuel type will be accompanied by a general description of the mobile sources using each fuel type. The description for motor vehicles using the fuel will include the number of on-road versus off-road vehicles by horsepower or gross vehicle weight and age.

10. Indirect Emissions

A. Repositories for Combustion Emissions by Facility

Pending coordination with CPUC/CEC, ARB is considering compiling annual CO_2 emissions and annual generation by facility for in-state generation as reported by individual facilities. The repository would be available to utilities to calculate emissions associated with specified in-state purchases.

Also pending coordination with CPUC/CEC, ARB may provide a repository for out-of-state facilities based on EIA and U.S. EPA Part 75 data. The operator of an out-of-state coal facility would have the option to replace Part 75 CEMS data with *verified* emissions calculated from the fuel-based methodology provided for coal in the ARB regulation.

The provision of repositories would insure consistency in calculations for specified purchases. ARB is considering sequential reporting with power generating facilities reporting first, followed by retail providers. The retail providers would report utility-level emission factors for use by down-stream retail customers. The ARB database would use the factors to calculate indirect emissions. ARB is considering the feasibility of this approach.

B. Indirect Emissions from Power Purchased and Consumed

Utilities will report power purchased and consumed for end-use in buildings/facilities owned by utilities (not power consumed in power generation). CO_2 emissions will be calculated in the ARB database using utility level emission factors from ARB's repository. These emissions will be categorized as indirect emissions and kept separate from direct emissions. The following methodology will be used

CO_2 Methodology for Indirect Power Purchased and Consumed

$$CO_2 = MWh * REF$$

Where
CO_2 = CO_2 emissions, annual metric tons
MWh = the number of MWh purchased
REF = ARB repository emission factor, MWh per metric ton

N2O and CH4 Methodology for Indirect Power Purchased and Consumed

N_2O and CH_4 emissions will use the same methodology substituting the CO_2 emission factor with the appropriate ARB repository emission factor for N_2O or CH_4.

11. Verification

Annual verification would be required for all data. Stipulations on verifiers would be consistent with the general reporting section of the regulation; however, additional requirements may apply to power sector verifiers. The regulation will specify record keeping requirements for back-up calculations.

12. Discussion on Co-Generation and Self-Generation

Reporting requirements from co-generation and self-generation facilities will be discussed in a separate section of the regulation devoted to these facilities. Combustion emissions from co-generation and self-generation will be based on methodologies consistent with the power sector of the regulation; however, emissions will be categorized separately in the ARB database. In addition to total emissions, reporters will report total thermal energy (BTUs) produced and total electricity (MWh) produced plus breakdown for thermal energy sold and consumed and for electricity sold and consumed.

Co-generation and self-generation operators will also report separate emissions from thermal energy production and emissions from electricity production. ARB's database would calculate emission factors to be used in indirect emissions calculations for users of the thermal energy or electricity. The ratio of CO_2 assigned to thermal energy divided by total BTU produced would be the thermal energy emission factor. The CO_2 assigned to electricity divided by total electricity produced would be the electricity factor. ARB prefers that a single methodology be required to determine the split in emissions between thermal energy and electricity. ARB will continue to consult with co-generation and self-generation operators and associations and with the CPUC/CEC.